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(71) Applicant
Sabre Safety Limited

(Incorporated in United Kingdom)

Ash Road, Aldershot, Hampshire GU12 4DE

(72) Inventor
Michael Harvey Glynn

(74) Agent and/or Address for Service
Hustwitt & Co,
St George's House, 44 Hatton Garden, London EC1N 8ER

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| GB A 2114450 | GB 0482492 | EP A1 0022258 |
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F4P
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F17C

# (54) Device for controlling the release of breathable gas from a storage means

(57) A combined gas release and gas pressure measuring device 2 includes a control orifice capsule 4 fitted to an end portion 6 of a cylindrical housing 3. The capsule 4 includes a chamber 10, of which a first wall 13 separates the interior of the capsule 4 from the interior of the housing 3, and a second wall 11 contains an orifice 12 of a size such that gas may flow through the orifice 12 at a controlled rate suitable for supplying breathable gas to a breathing system. A normally sealed gas delivery tube 15 and a substantially helical Bourdon tube 16 are mounted in the first wall 13 of the chamber 10, with the gas delivery tube 15 positioned axially relative to both the cylindrical housing 3 and the helical Bourdon tube 16. The orifice 12 can thus communicate with both the gas delivery tube 15 and the Bourdon tube 16 via the chamber 10 of the capsule 4. The device 2 is either mounted in, or integral with, a gas cylinder 1 containing breathable gas stored under pressure.

In the embodiment described the gas cylinder 1 having the device 2 mounted therein is secured within a breathing bag (34) Fig. 2, (not shown) of a breathing system with the indicator 17 of the Bourdon gauge 16 visible through a transparent window (33) in the breathing bag (34). Gas is released from the cylinder 1 by gripping a knob 22 and moving it to break the seal in the normally sealed gas delivery tube 15.

FIG. 1.

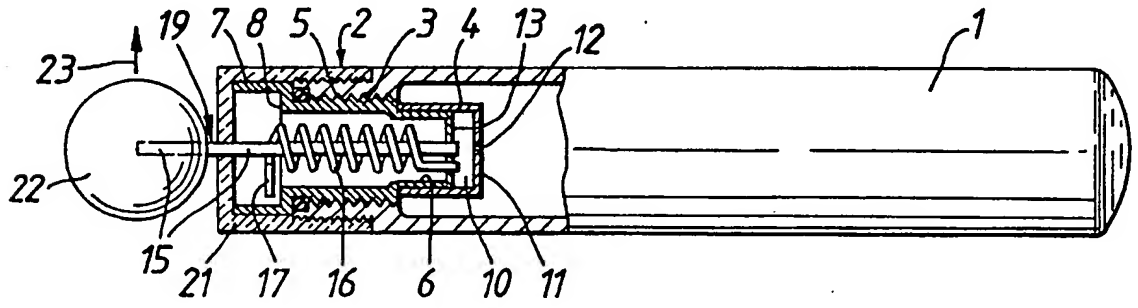


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FIG. 1.

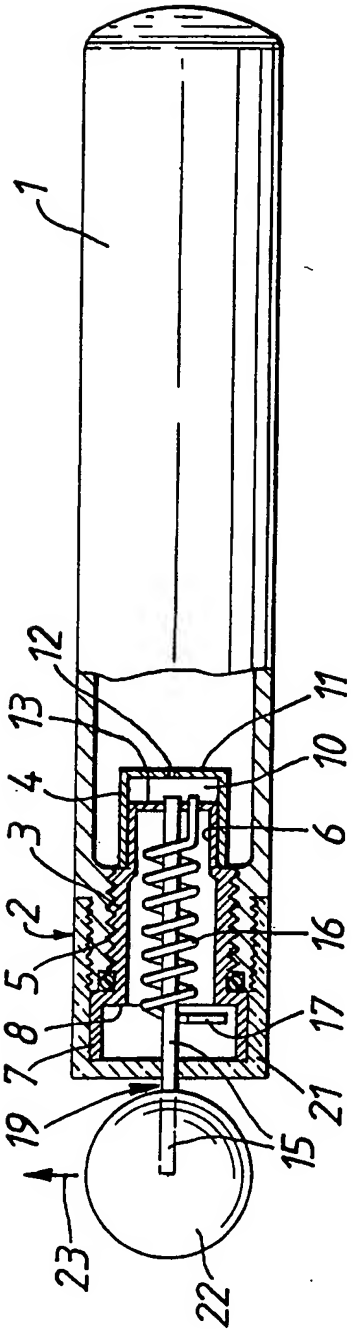
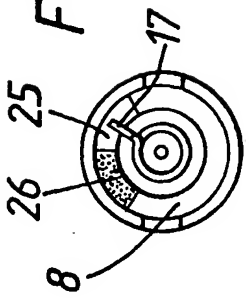



FIG. 2.



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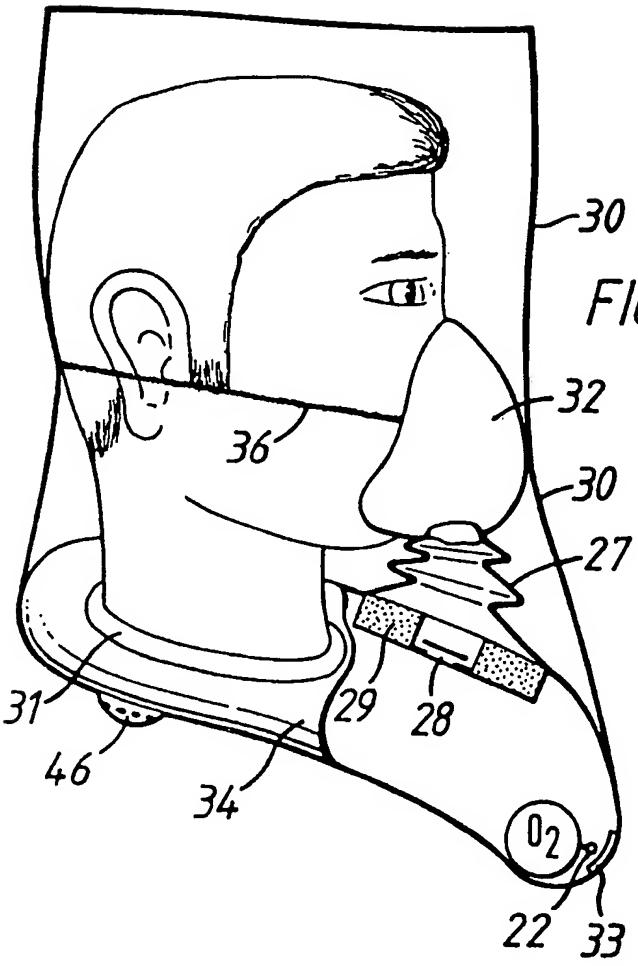


FIG.3

SPECIFICATION

**Device for controlling the release of breathable gas from a storage means**

The present invention relates to a device for controlling the release of breathable gas from a storage means in which the gas is stored under pressure, for example a gas cylinder, and also to emergency escape breathing apparatus including such a device.

It is obviously important to the user of any breathing apparatus which has its own gas storage means to be able to check that there is a substantial gas pressure within the storage means and that consequently a suitable supply of breathable gas is available. In particular in emergency escape breathing apparatus provided in a location from which escape must be made in the event of fire, for example in a civil aircraft, it is important to see on inspection of the apparatus that the gas cylinder is properly charged with breathable gas under pressure.

It is also a requirement for systems in which breathable gas is supplied from a storage means in which the gas is stored under pressure that the gas shall be released in a controlled manner, for example as a result of passing through a restrictor, so that the gas is delivered to the user of the breathing apparatus at a suitable pressure and rate of supply.

According to the present invention there is provided a device for controlling the release of breathable gas from a storage means in which the gas is stored under pressure, the device comprising a member having therein an orifice of a size such that gas may flow therethrough at a controlled rate suitable for supplying breathable gas to a breathing system, and means enabling the orifice to communicate with both a normally sealed gas delivery tube and a pressure gauge.

The device according to the present invention is therefore a combined gas release and gas pressure measuring device which is advantageously of a simple and compact design. Conveniently, the pressure gauge or gas pressure measuring device is a Bourdon gauge, which is a known pressure gauge based on a curved tube which tends to straighten under increased internal pressure thus indicating, by the movement of an indicator over an arcuate scale, the gas pressure applied to it. Such a tube will be referred to herein as a Bourdon tube.

The means enabling the orifice to communicate with both the gas delivery tube and the pressure gauge may be a common connection formed by soldering the Bourdon tube and the gas delivery tube to the orifice member and to each other.

Preferably, however, the said means comprises a chamber, the orifice member constitutes a wall of the chamber, and the gas delivery tube and pressure gauge are both mounted in another wall of the chamber to communicate with the interior of the chamber.

Further in accordance with the present invention there is provided a device for controlling the release of breathable gas from a storage means in which the gas is stored under pressure, the device comprising a longitudinally extending housing, a control orifice capsule mounted at one end of the housing, the capsule including a first wall separating the interior of the capsule from the interior of the housing and a second wall having therein an orifice of a size such that gas may flow therethrough at a controlled rate suitable for supplying breathable gas to a breathing system, a substantially helical Bourdon tube mounted in the said first wall such that the Bourdon tube is positioned within the housing and communicates with the interior of the capsule, and a normally sealed gas delivery tube mounted in the said first wall such that the gas delivery tube is located within the housing substantially axially to the housing and the Bourdon tube, and the gas delivery tube communicates with the interior of the capsule.

Preferably, the end of the housing remote from the control orifice capsule is enlarged to provide an outwardly facing surface which bears a scale for the indicator of the Bourdon tube.

Conveniently, a guide tube is provided within the housing such that the guide tube is within the helix of the Bourdon tube and the gas delivery tube is within the guide tube.

The device in accordance with the present invention may be provided as a device separate from the gas storage means to which it is secured, for example, by a screw thread on the exterior of the housing which enables the housing to be located in a gas storage means. Alternatively the device according to the invention may be formed integrally with the gas storage means, for example as part of a gas cylinder.

Although the gas delivery tube of the device according to the invention may be sealed by a valve sealing member, the gas delivery tube is preferably sealed by mechanical deformation. Gas supply from the gas storage means is then initiated by breaking the end of the gas delivery tube to remove the sealed portion whereupon gas flows from the gas storage means to the breathing apparatus. This construction is particularly favoured when the gas storage means is designed for supplying gas to emergency escape breathing apparatus, for example emergency escape breathing apparatus including a part-transparent flexible hood which the wearer places over his head while making his escape.

According to a preferred embodiment of this aspect of the present invention there is provided emergency escape breathing apparatus comprising a flexible hood at least part of

which is transparent for enveloping the head of a wearer, a half mask in the interior of the hood, the half mask being engageable with the wearer's face to cause all the gas breathed by the wearer to be inhaled from or exhaled to the space within the half mask, a source of breathable gas under pressure, means for supplying breathable gas from the said source to a breathing bag, said means including a combined gas release and gas pressure measuring device which comprises a Bourdon gauge and a normally sealed gas delivery tube both connected to receive breathable gas from one orifice which communicates with gas under pressure in said source, the orifice being of a size such that gas may flow therethrough at a controlled rate suitable for supplying breathing gas from the gas delivery tube to the breathing bag when the seal of the gas delivery tube is broken, and connecting means connecting the interior of the half mask to the breathing bag such that gas is supplied to the interior of the half mask from the breathing bag upon inhalation by the wearer.

However, the device according to the present invention for controlling the release of breathable gas from a storage means in which the gas is stored under pressure is generally desirable in emergency escape breathing apparatus which includes a flexible hood, at least part of which is transparent, and means for supplying breathable gas to the hood from a gas storage means in which gas is stored under pressure, irrespective of the presence of a breathing bag or of a half mask within the hood.

According to another aspect of the present invention there is provided breathing apparatus which includes a breathing bag for providing a reservoir of breathing gas for supply to a user of the apparatus, and gas storage means secured within the breathing bag, the gas storage means including a normally sealed gas delivery tube extending from the gas storage means and communicating with an orifice in the gas storage means, the orifice being of a size such that gas may flow therethrough at a controlled rate suitable for supplying breathable gas to a breathing system whereby breathing gas is delivered from the gas storage means to form the reservoir of breathing gas upon breaking of the seal to the gas delivery tube.

Breathing apparatus according to this aspect of the present invention may be of the emergency escape type which includes a flexible hood, but need not be as the reservoir of gas could feed breathable gas directly to a face piece, which term includes all of a full face mask, a half mask and a quarter mask. When the breathing apparatus includes a flexible hood this may also include a half mask to which the breathable gas is supplied. All inhaled gas will then be received from the reservoir via the half mask, but exhaled gas may be directed from the half mask to the interior of the hood or back to the breathing bag. In the latter case the breathed gases are completely isolated from the interior of the hood outside the half mask and the means feeding breathable gas from the reservoir to the half mask. A carbon dioxide filter for removing carbon dioxide from the exhaled gases is preferably provided in these last circumstances.

Advantageously, the normally sealed gas delivery tube has a knob beyond the seal thereon, said knob being capable of being moved relative to the gas delivery tube by engagement of the knob through the breathing bag to break the seal of the gas delivery tube.

The present invention will be further understood from the following detailed description of a preferred embodiment thereof which is made, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a view in part cross-section of a gas cylinder including a combined gas release and gas pressure measuring device in accordance with the present invention,

Figure 2 is an end view taken from the left of Figure 1 showing the scale of the Bourdon gauge, and

Figure 3 is a diagrammatic representation in part cross-section of emergency escape breathing apparatus including the gas cylinder and device of Figures 1 and 2.

Referring to Figure 1 of the accompanying drawings there is shown a gas cylinder 1 in which there is stored under pressure a breathable gas which may be either air or oxygen or a mixture of oxygen and air. In the mouth of the gas cylinder 1 there is mounted a combined gas release and gas pressure measuring device indicated generally by the reference numeral 2,

The device 2 includes a cylindrical housing 3 and a control orifice capsule 4. The main body of the housing 3 has a screw thread 5 formed on its external surface for engaging a corresponding screw thread on the gas cylinder 1. The control orifice capsule 4 is fitted to an end portion 6 of the housing 3 which has a smooth cylindrical external surface over which an open cylindrical portion of the capsule 4 is a gas-tight fit. The opposite end portion 7 of the housing 3 is of enlarged diameter compared with the main body of the housing 3 to provide an outwardly facing surface 8 which bears a scale for the pressure indicator as will be described with reference to Figure 2.

The control orifice capsule 4 includes a chamber 10 of which a wall 11 contains an orifice 12 or restrictor aperture of a size such that gas may flow therethrough at a controlled rate suitable for supplying breathable gas to a breathing system such as an emergency escape breathing apparatus. The orifice 12 is of a diameter selected to suit the rate of gas

delivery required, for example 0.05 millimetres diameter.

An opposite wall 13 of the chamber 10 of the control orifice capsule 4 has mounted therein a gas delivery tube 15 and a substantially helical Bourdon tube 16, the other end 17 of which has a straight portion forming an indicator for indicating the pressure within the gas cylinder 1 on a scale on the outwardly facing surface 8 at the enlarged portion of the housing 3. The gas delivery tube 15 is positioned axially relative to both the cylindrical housing 3 and the helical Bourdon tube 16. A guide tube (not shown) may be mounted on the wall 13 so as to be positioned within the helical Bourdon tube 16 to provide a support for the gas delivery tube 15 and thus reduce the possibility of the gas delivery tube 15 moving from its axial position with the result that there are set up stresses which might break the sealing connection of the gas delivery tube 15 to the wall 13 of the chamber 10 of the capsule 4.

The device 2 mounted in the gas cylinder 1 is enclosed by a transparent cover 21 which is screw mounted to the gas cylinder 1. The gas delivery tube 15 extends through an aperture in the cover 21 in which the tube 15 is sealed. At a position outside the cover 21, the gas delivery tube 15 is sealed by a crimp 19 which is a mechanical deformation in the gas delivery tube 15. A knob 22, which is a clear ball of transparent plastics material, is mounted to the end of the gas delivery tube 15 beyond the crimp seal 19. When gas is to be delivered from the gas cylinder 1 the knob 22 may be gripped and pulled, for example to one side in the direction of arrow 23, so that the gas delivery tube 15 is broken at the seal 19 and gas is discharged from the interior of the cylinder 1 through the orifice 12 and the gas delivery tube 15. One example of a means of utilising the gas in emergency escape breathing apparatus will be described with reference to Figure 3.

The Bourdon tube is provided as a pressure gauge for showing the gas pressure in the cylinder 1, so that the breathing apparatus of which the device 1 is a part is known to have a sufficient supply of breathable gas, before being put into operation by breaking the seal 19 as just described. The indicator 17 on the Bourdon gauge is shown in Figure 2 as it will be seen when checked by supervising staff, a scale on surface 8 being viewed through the knob 22 and the cover 21. Preferably, a simple scale is employed having two coloured portions of which a green portion 25 indicates a sufficient gas pressure in the gas cylinder 1 and a red portion 26 indicates that the gas pressure has fallen to a level at which the gas cylinder 1 should be replaced or recharged.

In Figure 3 of the accompanying drawings there is shown emergency escape breathing apparatus which includes a source of breathable gas, for example oxygen, and a combined gas release and gas pressure measuring device as described with reference to Figures 1 and 2. The emergency escape breathing apparatus includes a flexible hood 30, made for example of the heat-resistant transparent plastics material obtainable under the name Kapton, in position on the head of a wearer. The hood 30 includes a half mask 32 secured to the inside of the hood 30 in a position such that the half mask 32 engages the face of the wearer over his nose,mouth and chin, the half-mask 32 being retained in position against the face of the wearer by a suitable head harness,for example elastic 36, incorporated in the hood 30.

Affixed to the lower open end of the hood 30 is a breathing bag 34 in the shape of a ring and having a neck seal 31 provided on the inside edge of the ring-shaped breathing bag 34. The breathing bag 34 is provided to constitute a reservoir of breathable gas isolated from the interior of the hood 30, gas being supplied from the breathing bag 34 through a flexible connecting means 27, an inhale valve 28 and an annular carbon dioxide absorbent filter 29.

The oxygen cylinder 1 having the combined gas release and gas pressure measuring device described with reference to Figures 1 and 2 is secured within the breathing bag 34 at a position near a transparent window 33 in the breathing bag 34 enabling an observer to view the reading of the Bourdon gauge as already described. The knob 22 is also observable and able to be gripped for movement to break the seal thereby causing oxygen to be delivered direct into the interior of the breathing bag 34 for use by the wearer of the emergency escape breathing apparatus.

The breathing bag 34 may additionally include an exhale valve 46 to safeguard against an undue pressure rise in the breathing bag 34.

CLAIMS

1. A device for controlling the release of breathable gas from a storage means in which the gas is stored under pressure, the device comprising a member having therein an orifice of a size such that gas may flow therethrough at a controlled rate suitable for supplying breathable gas to a breathing system, and means enabling the orifice to communicate with both a normally sealed gas delivery tube and a pressure gauge.

2. A device according to Claim 1, wherein the pressure gauge includes a Bourdon tube and wherein the said means comprises a common connection formed by soldering the Bourdon tube and the gas delivery tube to the orifice member and to each other.

3. A device according to Claim 1, wherein the said means comprises a chamber, the orifice member constitutes a wall of the cham-

ber, and the gas delivery tube and pressure gauge are both mounted in another wall of the chamber to communicate with the interior of the chamber.

4. A device for controlling the release of breathable gas from a storage means in which the gas is stored under pressure, the device comprising a longitudinally extending housing, a control orifice capsule mounted at one end of the housing, the capsule including a first wall separating the interior of the capsule from the interior of the housing and a second wall having therein an orifice of a size such that gas may flow therethrough at a controlled rate suitable for supplying breathable gas to a breathing system, a substantially helical Bourdon tube mounted in the said first wall such that the Bourdon tube is positioned within the housing and communicates with the interior of the capsule, and a normally sealed gas delivery tube mounted in the said first wall such that the gas delivery tube is located within the housing substantially axially to the housing and the Bourdon tube, and the gas delivery tube communicates with the interior of the capsule.

5. A device according to Claim 4, wherein the end of the housing remote from the control orifice capsule is enlarged to provide an outwardly facing surface which bears a scale for the indicator of the Bourdon tube.

6. A device according to Claim 4 or Claim 5, wherein a guide tube is provided within the housing such that the guide tube is within the helix of the Bourdon tube and the gas delivery tube is within the guide tube.

7. A device according to any one of Claims 4 to 6, in which the exterior of the housing has a screw thread for locating the housing in a gas storage means.

8. A device according to any one of Claims 1 to 6, which is formed integrally with the gas storage means.

9. A device according to any one of Claims 1 to 8, in which the gas delivery tube is sealed by mechanical deformation.

10. A device according to any one of Claims 1 to 8, in which the gas delivery tube is sealed by a valve member.

11. A device which is a combined gas release and gas pressure measuring device substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawings.

12. Emergency escape breathing apparatus including a flexible hood at least part of which is transparent, and means for supplying breathable gas to the hood, the said means including gas storage means and a device in accordance with any one of the preceding claims.

13. Emergency escape breathing apparatus comprising a flexible hood at least part of which is transparent for enveloping the head of a wearer, a half mask in the interior of the hood, the half mask being engageable with the wearer's face to cause all the gas breathed by the wearer to be inhaled from or exhaled to the space within the half mask, a source of breathable gas under pressure, means for supplying breathable gas from the said source to a breathing bag, said means including a combined gas release and gas pressure measuring device which comprises a Bourdon gauge and a normally sealed gas delivery tube both connected to receive breathable gas from one orifice which communicates with gas under pressure in said source, the orifice being of a size such that gas may flow therethrough at a controlled rate suitable for supplying gas from the gas delivery tube to the breathing bag when the seal of the gas delivery tube is broken, and connecting means connecting the interior of the half mask to the breathing bag such that gas is supplied to the interior of the half mask from the breathing bag upon inhalation by the wearer.

14. Emergency escape breathing apparatus according to Claim 13, wherein the source of breathable gas is a gas cylinder positioned within the interior of the breathing bag which has a transparent portion therein enabling the gas pressure measuring device to be observed, and wherein the normally sealed gas delivery tube has a knob beyond the seal thereon, said knob being capable of being gripped through the breathing bag for movement of the knob to break the seal of the gas delivery tube.

15. Emergency escape breathing apparatus according to Claim 14, wherein the knob is disposed on a continuation of the gas delivery tube and over a scale for the Bourdon gauge, and the knob is made of a transparent material.

16. Breathing apparatus which includes a breathing bag for providing a reservoir of breathing gas for supply to a user of the apparatus, and gas storage means secured within the breathing bag, the gas storage means including a normally sealed gas delivery tube extending from the gas storage means and communicating with an orifice in the gas storage means, the orifice being of a size such that gas may flow therethrough at a controlled rate suitable for supplying breathable gas to a breathing system whereby breathing gas is delivered from the gas storage means to form the reservoir of breathing gas upon breaking of the seal to the gas delivery tube.

17. Breathing apparatus according to Claim 16, which further comprises a flexible hood at least part of which is transparent, and means connecting the breathing bag to the interior of the hood so that the reservoir may supply breathing gas to the interior of the hood.

18. Breathing apparatus according to Claim 16, which further comprises a face piece and means connecting the breathing bag to the face piece so that the face piece may be supplied with breathing gas from the reservoir.

19. Breathing apparatus according to Claim 16, which further comprises a flexible hood at least part of which is transparent, a half mask attached to the interior of the hood, and means connecting the breathing bag to the half mask so that the half mask may be supplied with breathing gas from the reservoir.

20. Breathing apparatus according to any one of Claims 16 to 19 wherein the normally sealed gas delivery tube has a knob beyond the seal thereon, said knob being capable of being moved relative to the gas delivery tube by engagement of the knob through the breathing bag to break the seal of the gas delivery tube.

21. Emergency escape breathing apparatus substantially as hereinbefore described with reference to Figure 3 of the accompanying drawings.

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